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Attorney Docket No. 400113/ASAHINA

First Named Inventor HIROAKI SATOH

APPLICATION ELEMENTS

1. ☒ Transmittal Form with Fee
2. ☒ Specification (including claims and abstract) [Total Pages 29]
3. ☒ Drawings [Total Sheets 1]
4. ☒ Combined Declaration and Power of Attorney [Total Pages 3]
 - a. ☒ Newly executed
 - b. ☐ Copy from prior application [Note Box 5 below]
 - i. ☐ Deletion of Inventor(s) Signed statement attached deleting inventor(s) named in the prior application
5. ☐ Incorporation by Reference: The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ Microfiche Computer Program
7. ☐ Nucleotide and/or Amino Acid Sequence Submission
 - a. ☐ Computer Readable Copy
 - b. ☐ Paper Copy
 - c. ☐ Statement verifying above copies

ACCOMPANYING APPLICATION PARTS

8. ☒ Assignment Papers
9. ☐ Power of Attorney
10. ☐ English Translation Document (if applicable)
11. ☐ Information Disclosure Statement (IDS)
 - ☐ PTO-1449 Form
 - ☐ Copies of IDS Citations
12. ☒ Preliminary Amendment
13. ☒ Return Receipt Postcard (Should be specifically itemized)
14. ☐ Small Entity Statement(s)
 - ☐ Enclosed
 - ☐ Statement filed in prior application; status still proper and desired
15. ☐ Certified Copy of Priority Document(s)
16. ☐ Other:

17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information in (a) and (b) below:
- (a) ☐ Continuation ☐ Divisional ☐ Continuation-in-part of prior application Serial No. .
- (b) Preliminary Amendment: Relate Back - 35 USC 120. The Commissioner is requested to amend the specification by inserting the following sentence before the first line:
 "This is a ☐ continuation ☐ divisional of copending application(s)
☐ Serial No. , filed on .
☐ International Application, filed on , and which designates the U.S."

APPLICATION FEES

BASIC FEE				\$760.00
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total Claims	9	-20=	0	x \$18.00 \$ 00.00
Independent Claims	1	- 3=	0	x \$78.00 \$ 00.00
<input type="checkbox"/> Multiple Dependent Claims(s) if applicable				+ \$260.00 \$ 00.00
Total of above calculations =				\$ 760.00
Reduction by 50% for filing by small entity =				\$(00.00)
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TOTAL =				\$ 800.00

UTILITY PATENT APPLICATION TRANSMITTAL

Attorney Docket No. 400113

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20. ☒ A check in the amount of \$800.00 is enclosed.
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Signature



Date

March 18, 1999

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

HIROAKI SATOH

Filed: March 18, 1999

For: PROCESS FOR FORMING A
PATTERN OF FLUORESCENT
SUBSTRATE AND PLASMA
DISPLAY PANEL

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Prior to examination, please amend the referenced patent application as shown below.

IN THE SPECIFICATION

Page 4, line 10, change "following" to --flowing--;

line 14, change "following" to --flowing--.

Page 5, line 2, change "maleinic" to --maleic--.

Page 7, line 8, change "Example" to --Examples--.

Page 13, line 12, change "(Formation" to --Formation--;

line 22, change "{Formation}" to --Formation--;
change "cell)" to --cell--.

delete ")".

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delete ")";
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delete ")";
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change "cell)" to --cell--;

delete ")".

delete "]".

delete "]",

line 4, change "layer)" to --layer--;

```
delete ")";
```

2

In re Appln. of Hiroaki Satoh

delete ")".

Page 20, line 15, delete "[";

delete "]".

Page 21, line 12, delete "[";

delete "]".

Page 24, line 7, delete "[";

delete "]".

Page 25, line 7, delete "[";

delete "]".

REMARKS

The foregoing Amendment improves the form of the application without adding new matter.

Respectfully submitted,

LEYDIG, VOIT & MAYER



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XP:ves

09271447-031899

SPECIFICATION

BE IT KNOWN THAT I, HIROAKI SATOH residing at c/o The Nippon Synthetic Chemical Industry Co., Ltd., Central Research Laboratory, 13-1, Muroyama 2-chome, Ibaraki-shi, Osaka-fu, Japan, a subject of Japan, have invented certain new and useful improvements in

PROCESS FOR FORMING A PATTERN OF FLUORESCENT SUBSTRATE AND PLASMA DISPLAY PANEL

of which the following is a specification:-

PROCESS FOR FORMING A PATTERN OF FLUORESCENT SUBSTRATE
AND PLASMA DISPLAY PANEL

BACKGROUND OF THE INVENTION

The present invention relates to a process for forming a pattern of fluorescent substance into the cell in the process of producing a fluorescent substance display device such as a plasma display panel
5 (hereinafter referred to as "PDP").

Recently various flat display panels have been developed strongly. Among those, PDP has attracted considerable attention. The PDP has been used largely for a display panel of a laptop personal computer, various electric score boards, and a so-called "wall-hanging
10 television".

Inside the cell of display panel of PDP, a fluorescent substance for displaying was sealed and fixed, the fluorescent substance emits color by ultraviolet lights generated in a gas sealed inside the cell by adding voltage.

15 As a process for forming a pattern of fluorescent substance, there has been employed a liquid photo resist containing dispersed fluorescent substances having each color. In order to improve the process for formation, the present inventor proposed a dry film resist (photo resist film) containing a fluorescent substance instead of the
20 liquid photo resist (Japanese Unexamined Patent Publication No.273925/1994). And in order to improve the fixing efficiency of fluorescent substance, there was provided a process for forming a pattern by using a laminated film of an acrylic resin layer and a photosensitive resin composition layer containing a fluorescent

substance (Japanese Unexamined Patent Publication No.69339/1997).

And in order to obtain the accurate and uniform pattern of fluorescent substance, there were proposed a process that the photosensitive thermoplastic resin layer was glued on the photosensitive resin composition layer by heating and pressing, and then it was exposed, developed and baked (Japanese Unexamined Patent Publication No.199027/1997), and a process that a photosensitive element, which contains a photosensitive thermoplastic resin layer on a supporting film and a photosensitive resin composition layer containing a fluorescent substance thereon, was glued by heating and pressing in contact with the photosensitive resin composition layer containing a fluorescent substance on the PDP substrate, and then it was exposed, developed and baked (Japanese Unexamined Patent Publication No.199030/1997).

SUMMARY OF THE INVENTION

However, in the photo resist film described in Japanese Unexamined Patent Publication No.273925/1994, there was not sufficiently investigated filling of fluorescent substance into the cell.

On the other hand, in the process considering the filling described in Japanese Unexamined Patent Publication No.273925/1994, the filling amount of fluorescent substance into the cell was secured, but the fluorescent substance was not fixed uniformly and efficiently in a side and bottom wall of the cell (filling up property), since the photosensitive resin composition layer was laminated after forming the acrylic resin layer containing no fluorescent substance.

And in the processes described in Japanese Unexamined

Patent Publication Nos.199027/1997 and 199030/1997, the filling up property was comparatively well since the layer containing a fluorescent substance was formed on the side wall of the cell. But possibility of pattern defects at baking was high since the layer containing a fluorescent substance was given photo polymerization.

Under these circumstances, it is an object of the present invention to form the pattern of fluorescent substance uniformly in order to effectively emit the fluorescent substance filled in the cell and not to form pattern defects on the side and bottom wall of the cell at baking mentioned above. And the secondarily economical effect can be expected, in which an amount of fluorescent substance can be decreased due to realization of forming such pattern of fluorescent substance.

Namely, the present invention relates to a process for forming a pattern of fluorescent substance into the cell of a fluorescent substance display substrate, wherein a resin composition (A) layer, comprising an acrylic polymer (a) having a weight average molecular weight of 10000 to 300000 and an acid number of 80 to 250 mgKOH/g and a fluorescent substance (b) and a photosensitive resin composition (B) layer are formed inside the cell, and then they are exposed, developed and baked. By the present invention a pattern of fluorescent substance is effectively formed since the composition follows sufficiently on the side and bottom wall of the cell (excellent filling up property).

BRIEF EXPLANATION OF THE DRAWINGS

Figs.1(a)-1(d) show an explanatory drawing which expresses a process for forming a pattern of fluorescent substance of PDP by the present invention of the process for forming a pattern of fluorescent

substance.

DETAILED DESCRIPTION

As the resin composition (A) layer employed in the present invention, there is used the resin composition (A) comprising an acrylic polymer (a) and a fluorescent substance (b).

A glass transition temperature Tg of the acrylic polymer (a) is preferably less than 30°C, more preferably less than 25°C. From the viewpoint of fluidity and storing stability. If Tg is not less than 30°C, sufficient fluidity is not obtained at lamination and following property tends to be bad.

On the other hand, even if an acrylic polymer having Tg of not less than 30°C, the fluidity is improved by adding an organic compound (c) mentioned below and the poor following property is also improved. In this case Tg is preferably 40 to 200°C, more preferably 45 to 175°C.

And an acrylic copolymer and an acrylic copolymer containing an acetoacetyl group can be also employed, in which (meth)acrylate is a main component and which is co-polymerized with an ethylenically unsaturated carboxylic acid and the other co-polymerizable monomers if necessary.

Examples of the (meth)acrylate are methyl (meth)acrylate, ethyl (meth)acrylate, propyl (meth)acrylate, butyl (meth)acrylate, hexyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, cyclohexyl (meth)acrylate, benzyl (meth)acrylate, dimethylaminoethyl (meth)acrylate, hydroxyethyl (meth)acrylate, hydroxypropyl (meth)acrylate, gricidyl (meth)acrylate and the like.

Examples of the ethylenically unsaturated carboxylic acid are

a mono carboxylic acid such as acrylic acid, methacrylic acid and crotonic acid, a dicarboxylic acid such as maleinic acid, fumaric acid and itaconic acid, an acid anhydride thereof and a half ester thereof. Among those, acrylic acid and methacrylic acid are more preferable.

- 5 Examples of the other co-polymerizable monomer are acrylamide, methacrylamide, acrylonitrile, styrene, α -methylstyrene, vinyl acetate, alkyl vinyl ether and the like.

- 10 The acrylic polymer (a) has preferably a weight average molecular weight of 10000 to 300000 and an acid number of 80 to 250mgKOH/g. It has more preferably a weight average molecular weight of 30000 to 200000 and an acid number of 95 to 175mgKOH/g. If the weight average molecular weight is below 10000, maintaining property of film becomes insufficient. If the weight average molecular weight is above 300000, developing property becomes low. And if the acid number is below 80mgKOH/g, developing property becomes low. If the acid number is above 250mg/KOH/g, resistance for developer becomes low.

- 20 The fluorescent substance (b) employed in the present invention can be employed without particular limitation, the substrate is preferable, in which the nuclei thereof is a rare earth metal oxyhalide and the nuclei is activated by an activating agent. Examples of the fluorescent substance, which is excited by a ultraviolet light, are $Y_2O_3:Eu$, $YVO_4:Eu$, $(Y,Gd)BO_3:Eu$ (red) ; $BaAl_{12}O_{19}:Mn$, $Zn_2SiO_4:Mn$, $LaPO_4:Tb$ (green) ; $BaMgAl_{14}O_{23}:Eu$, $BaMgAl_{16}O_{27}:Eu$ (blue) and the like.
- 25 The other examples thereof are $Y_2O_3S:Eu$, $\gamma-Zn_3(PO_4)_2:Mn$, $(ZnCd)S:Ag+In_2O_3$ (red) ; $ZnS:Cu,Al$, $ZnS:Au,Cu,Al$, $(ZnCd)S:Cu,Al$, $Zn_2SiO_4:Mn,As$, $Y_3Al_5O_{12}:Ce$, $Gd_2O_2S:Tb$, $Y_3Al_5O_{12}:Tb$, $ZnO:Zn$

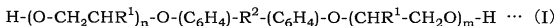
(green) ; ZnS:Ag+red dye, Y_2SiO_3 :Ce (blue) and the like.

The amount of the fluorescent substance (b) is preferably 1 to 1500 parts by weight, more preferably 10 to 800 parts by weight based on 100 parts by weight of the acrylic polymer (a). If the amount is below 1 part by weight, brightness becomes low for the lack of the amount of the fluorescent substance after forming a pattern. If the amount is above 1500 parts by weight, flexibility becomes low.

As a process of mixing the fluorescent substance (b), the conventional processes can be employed without particular limitation. Examples thereof are a process that the fluorescent substance (b) is uniformly dispersed by adding the pre-determined amount of the fluorescent substance (b) to the acrylic polymer (a) and mixing sufficiently, and the like.

Examples of the organic compound (c) employed in the present invention having viscosity of 5 to 15000 mPa · sec at 20°C are, for instance, a polyhydric alcohol compound, a compound containing at least one ethylenically unsaturated group, and the like.

The polyhydric alcohol compound (c) can be employed without particular limitation, examples thereof are, for instance, polyethylene glycol, polypropylene glycol, the compound represented by the following formula (I) and the like.



(wherein R^1 represents a hydrogen atom or a methyl group, R^2 represents $-CH_2-$, $-C(CH_3)_2-$ or $-S-$, n and m are a positive integer, and $n+m$ is 2 to 60)

The amount of the polyhydric alcohol compound is preferably 50 to 300 parts by weight, more preferably 100 to 250 parts by weight based on 100 parts by weight of the acrylic polymer (a). If the amount is below 50 parts by weight, flexibility becomes low. If the amount is above 300 parts by weight, storing property, such as cold flow and cohesion of the fluorescent substance, becomes low.

The ethylenically unsaturated compound (c) can be employed without particular limitation. Example thereof are polyethylene glycol di(meth)acrylate, polypropylene glycol di(meth)acrylate, bisphenol-A di(meth)acrylate modified with ethylene oxide, glycerin triacrylate, glycerin triacrylate modified with propylene oxide (PO) and the like. Among those, polypropylene glycol di(meth)acrylate, bisphenol-A di(meth)acrylate modified with ethylene oxide, glycerin triacrylate, glycerin triacrylate modified with propylene oxide (PO) are preferable.

The amount of the ethylenically unsaturated compound is preferably 50 to 300 parts by weight, more preferably 100 to 250 parts by weight based on 100 parts by weight of the acrylic polymer (a). If the amount is below 50 parts by weight, flexibility becomes low. If the amount is above 300 parts by weight, storing property, such as cold flow and cohesion of fluorescent substance, becomes low.

In case of employing the ethylenically unsaturated compound, it is necessary to employ the polymerization inhibitor (d) mentioned below.

The viscosity of the polyhydric alcohol compound or the ethylenically unsaturated compound at 20°C is preferably 5 to 15000 mPa · sec, more preferably 20 to 10000 mPa · sec, particularly 50 to 10000 mPa · sec. If the viscosity is below 5 mPa · sec, the compound is

sometimes separated due to migration at storing. If the viscosity is above 15000 mPa · sec, it becomes difficult to mix the fluorescent substance uniformly.

5 The photo polymerization inhibitor (d) employed in the present invention can be employed without particular limitation, example thereof are 2,2'-methylene bis(4-methyl-6-tert-butyl)phenol, quinones such as p-methoxyhydroquinone, thiuram disulfide and the like.

10 The amount of the photo polymerization inhibitor (d) is preferably 0.1 to 15 parts by weight, more preferably 0.2 to 10 parts by weight based on 100 parts by weight of the acrylic polymer (a). If the amount is below 0.1 part by weight, satisfactory pattern of fluorescent substance can not be obtained at baking due to the photo setting at the migration of the photo polymerization initiator from the photosensitive resin composition (B).
15 On the other hand, if the amount is above 15 parts by weight, plasticity increases, coloration and insufficient baking occurs.

In case of employing the ethylenically unsaturated compound as an organic compound (c), it is necessary to employ the polymerization
20 inhibitor (d). On the other hand, in case of employing the polyhydric alcohol compound, the polymerization inhibitor (d) may be suitably employed, if necessary.

The photo polymerization initiator and/or the photo polymerization initiator assistant can be employed in the present
25 invention, if necessary. As the photo polymerization initiator and/or the photo polymerization initiator assistant (e) employed in the present invention, example thereof are, for instance, benzoin, benzoin methyl

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- ether, benzoin ethyl ether, benzoin isopropyl ether, benzoin n-butyl ether, benzoin phenyl ether, benzyl diphenyl disulfide, benzyl dimethyl ketal, dibenzyl, diacetyl, anthraquinone, naphthoquinone, 3,3'-dimethyl-4-methoxybenzophenone, benzophenone, 4,4'-bis(dimethylamino)benzophenone, 4,4'-bis(diethylamino)benzophenone, pivaloin ethyl ether, 1,1-dichloroacetophenone, p-t-butylidichloroacetophenone, hexaaryl imidazole dimer such as 2,2'-bis(o-chlorophenyl)-4,5,4',5'-tetraphenyl-1,2'-biimidazole, 2-chlorothioxanthone, 2-methylthioxanthone, 2,4-diethylthioxanthone, 2,2'-diethoxyacetophenone, 2,2'-dimethoxy-2-phenylacetophenone, 2,2'-dichloro-4-phenoxyacetophenone, phenylglyoxylate, α-hydroxyisobutylphenone, dibenzosparone, 1-(4-isopropylphenyl)-2-hydroxy-2-methyl-1-propanone, 2-methyl-[4-(methylthio)phenyl]-2-morpholio-1-propanone, tribromophenylsulfone, tribromomethylphenylsulfone and the like.

The amount of the photo polymerization initiator and/or the photo polymerization initiator assistant (e) is preferably 0.1 to 20 parts by weight, more preferably 0.2 to 10 parts by weight based on 100 parts by weight of the base polymer (c) and the ethylenically unsaturated compound (d). If the amount is below 0.1 part by weight, sensitivity becomes remarkably low. If the amount is above 20 parts by weight, plasticity increases and stability of storing becomes low.

As the photosensitive resin composition (B) layer, the resin composition, which is photosensitive, can be employed without particular limitation. The resin composition preferably comprises a base polymer (f), an ethylenically unsaturated compound (g) and a photo polymerization initiator (h).

As the base polymer (f), there may be suitably employed a polyester resin, a polyurethane resin, an acrylic copolymer same as the above-mentioned acrylic polymer (a) which is co-polymerized with a (meth)acrylate component, if necessary, an ethylenically unsaturated carboxylic acid and the other co-polymerizable monomer. The base polymer (f) and the acrylic polymer (a) may be same or different.

The glass transition temperature of the base polymer (f) is preferably not less than 30°C, more preferably 45 to 175°C. The weight average molecular weight thereof is preferably 10000 to 300000, more preferably 30000 to 200000. And the photosensitive resin composition (B) may be the dilute-alkali developing type. If the composition is the dilute-alkali developing type, it is necessary to co-polymerize 15 to 40 % by weight of the ethylenically unsaturated carboxylic acid and to suitably employ the base polymer having an acid number of 65 to 310 mgKOH/g, more preferably 95 to 220 mgKOH/g.

Examples of the ethylenically unsaturated compound (g) are monomers having multi functional groups such as ethylene glycol di(meth)acrylate, diethylene glycol di(meth)acrylate, tetraethylene glycol di(meth)acrylate, propylene glycol di(meth)acrylate, polypropylene glycol di(meth)acrylate, butylene glycol di(meth)acrylate, neopentyl glycol di(meth)acrylate, 1,6-hexane glycol di(meth)acrylate, trimethylolpropane tri(meth)acrylate, glycerin di(meth)acrylate, pentaerythritol di(meth)acrylate, pentaerythritol tri(meth)acrylate, dipentaerythritol penta(meth)acrylate, 2,2-bis(4-(meth)acryloxydiethoxyphenyl)propane, 2,2-bis-(4-(meth)acryloxypolyethoxyphenyl)propane, 2-hydroxy-3-(meth)acryloyloxypropyl (meth)acrylate, ethylene glycol digricidyl ether

di(meth)acrylate, diethylene glycol digricidyl ether di(meth)acrylate, digricidyl phthalate di(meth)acrylate, glycerin triacrylate, and glycerin polyglicidyl ether poly(meth)acrylate.

5 A suitable amount of a monomer having mono functional group can be employed with these monomers having multi functional groups. Examples of the monomer having mono functional group are 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 2-hydroxybutyl (meth)acrylate, 2-phenoxy-2-hydroxypropyl (meth)acrylate, 2-(meth)acryloyloxy-2-hydroxypropyl phthalate, 3-chloro-2-hydroxypropyl (meth)acrylate, glycerin mono(meth)acrylate, 2-(meth)acryloyloxyethylacidphosphate, a half (meth)acrylate of a phthalic acid derivatives, N-methylol (meth)acrylamide and the like.

10 The amount of the ethylenically unsaturated compound (g) is preferably 20 to 100 parts by weight, more preferably 30 to 100 parts by weight based on 100 parts by weight of the base polymer (f). If the amount thereof is below 20 parts by weight, setting of the photosensitive resin composition (B) becomes insufficient, the rate of developing becomes long and the plasticity as a layer becomes low. If the amount is above 100 parts by weight, cold flow occurs and the peeling rate of the setting resist of the photosensitive resin composition (B) becomes low.

20 As the photo polymerization initiator (h), the initiator (e) same as mentioned above can be employed.

25 The amount of the photo polymerization initiator (h) is preferably 0.1 to 20 parts by weight, more preferably 0.2 to 10 parts by weight based on 100 parts by weight of the base polymer (f) and the unsaturated compound (g). If the amount is below 0.1 part by weight, sensitivity becomes remarkably low. If the amount is above 20 parts by

weight, plasticity increases and storing stability becomes low.

To the resin composition (A) containing the fluorescent substance and the photosensitive resin composition (B), there can be suitably added additive agents, for example, a dye (colorant, emission),
5 an adhesion-giving agent, a plasticizer, an antioxidant, a thermal polymerization inhibitor, a solvent, a surface-tension modifiers, a stabilizer, a chain-transferring agent, an antiforming agent, a flame retardant and the like.

The thickness (T_a) of the resin composition (A) layer is not
10 determined unconditionally since it depends on an amount of the fluorescent substance (b) and the structure of PDP. But the thickness is preferably thinner than the height (T_0) of the side wall of the cell. Further, $T_a(\mu\text{m})$ and $T_0(\mu\text{m})$ are preferably 1/20 to 10/20 of $T_a(\mu\text{m})/T_0(\mu\text{m})$, more preferably 1/20 to 10/20. If T_a/T_0 is below 1/20,
15 the thickness of the fluorescent substance after baking becomes insufficient. If T_a/T_0 is above 15/20, the space of the cell at discharge electricity becomes small.

The thickness (T_b) of the photosensitive resin composition (B) layer is not also determined unconditionally since it depends on the
20 structure of PDP. But the thickness is preferably thinner than the height (T_0) of the side wall of the cell. Further, $T_a(\mu\text{m}) / T_0(\mu\text{m})$ is preferably 1/20 to 10/20, more preferably 1/20 to 10/20 same as the above-mentioned T_a . If T_a/T_0 is below 1/20, it becomes difficult to press the resin composition (A) layer into the cell sufficiently. If T_a/T_0 is
25 above 15/20, patterning property becomes low.

In order to form layers by employing the resin composition (A) containing the fluorescent substance and the photosensitive resin

composition (B), it is possible to employ the liquid material thereof. But from the viewpoint of dispersion stability of additive, uniformity of applied film thickness, storing stability, following property to the cell and operation condition, it is preferable that the material is previously formed into a film. Concretely, it is preferable that the protecting film such as a polyethylene film or poly(vinylalcohol) film is covered on the application surface after the resin composition (A) and the photosensitive resin composition (B) are applied to the base film such as a polyester film, a polypropylene film and a polystyrene film.

Secondly, the process for forming a pattern of fluorescent substance is explained concretely based on Figs.1(a) to (d).

(Formation of the resin composition (A) in the cell)

The adhesive strength between the base film (polyester film, polyvinylalcohol film, nylon film, cellulose film etc) and the resin composition (A) layer of the laminate, in which the resin composition (A) layer containing the fluorescent substance is a middle layer, is compared with the adhesive strength between the protecting film and the resin composition (A) layer. After the film having less adhesion is removed, the side of the resin composition (A) layer is pushed into the cell previously formed in the PDP substrate by using a hot laminator to form the resin composition (A) layer 1 in the cell.

(Formation of the resin composition (B) in the cell)

After removing the film left on the surface of the resin composition (A) layer 1, the laminate, in which the photosensitive resin composition (B) layer 2 is a middle layer, is pushed thereon into the cell by using a hot laminator to form the photosensitive resin composition (B) layer 2 in the cell, in the same manner as in case of the above-mentioned

(A) layer 1.

The two layers of the resin composition (A) layer 1 and the photosensitive resin composition (B) layer 2 are laminated and filled in the cell of the PDP substrate. A ratio T_a/T_b of the thickness of (A) layer 5 (T_a) to (B) layer (T_b) is preferably 10/90 to 75/25.

Except the above-mentioned processes, the resin composition (A) layer 1 and the photosensitive resin composition (B) layer 2 is previously laminated, then the side of the (A) layer of the laminate ((A) layer/(B) layer/base film) is attached to the PDP substrate having the cell previously formed, and the laminate can be pushed into the cell by using a hot laminator. 10

Thereby the resin composition layer 1 and the photosensitive resin composition (B) layer 2 are formed (See Fig.1(a)). In Fig.1(a), a base film or a protecting film 8 is on the photosensitive resin composition (B) layer 2. 15 (Exposure)

A pattern mask 3 is closely contacted on the photosensitive resin composition (B) layer 2 to expose the composition (See Fig.1(b)). If the photosensitive resin composition (B) layer 2 is not adhesive, a pattern mask 3 can be directly contacted on the photosensitive resin composition (B) layer 2 to expose the composition on occasion demands after removing the film on the surface of the photosensitive resin composition (B) layer 2. Exposure is usually carried out by radiation of an ultraviolet light. Examples of the light source are a high-pressure 20 mercury lamp, an ultra-high-pressure mercury lamp, a carbon arc lamp, a xenon lamp, a metal halide lamp, a chemical lamp and the like. After irradiation by an ultraviolet light, heat treatment may be applied, if 25

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necessary, to ensure the setting.

(Development)

After exposure, the film on the photosensitive resin composition (B) layer 2 is removed, and the layer is developed to form the pattern 4 (See Fig.1(c)). Since the photosensitive resin composition (B) layer is the photosensitive resin composition of the dilute-alkali developing type, development after exposure is carried out by using 1 to 2 % by weight of a dilute alkali aqueous solution such as sodium carbonate and potassium carbonate. In this case, the developer of an organic alkali can be employed.

(Baking)

The substrate having formed cell after the above-mentioned treatment is baked at 450 to 550°C, and the fluorescent substance is fixed in the cell to form the pattern 5 of the fluorescent substance (See Fig.1(d)).

By the process of the present invention, the pattern of the fluorescent substance can be formed in the cell uniformly and perfectly not to form defects at baking. In order to obtain the full color PDP, the processes of (Formation of the resin composition (A) in the cell) to (Development) is carried out repeatedly by employing the resin composition (A) layer and the photosensitive resin composition (B) layers containing red, green, blue fluorescent substances. Concretely, baking is carried out after filling the three fluorescent substances (R(red), G(green), B(blue)) into the cell to form the red pattern of fluorescent substance 5, the green pattern of fluorescent substance 6, the blue pattern of fluorescent substance 7 (See Fig.1(d)).

EXAMPLES

The present invention is further explained in details based on the Examples concretely, but is not limited thereto. "Parts" in Examples means "parts by weight" unless otherwise specified.

5

EXAMPLE 1

The resin compositions (A) were prepared by using 70 parts of the following acrylic polymer (a) and 30 parts of the following fluorescent substance (b) (red, green, blue were separately employed).

10 [Resin composition (A)]

Acrylic polymer (a)

copolymer of methyl methacrylate, n-butyl acrylate and methacrylic acid, ratio of copolymer 17/62/21 based on weight

15 (glass transition temperature 6.5°C, weight average molecular weight 90000, acid number 137 mgKOH/g)

Fluorescent substance (b)

(Y, Gd, Eu)BO₃ (red)

(emission wavelength : 593 nm, 610 nm, 626 nm,

particle diameter : 2 - 4 μm, specific gravity : 5.1)

20 (Zn, Mn)₂SiO₄ (green)

(emission wavelength : 529 nm, particle diameter : 2 - 6 μm,

specific gravity : 4.2)

(Ba, Eu)MgAl₁₀O₁₇ (blue)

(emission wavelength : 451 nm, particle diameter : 2 - 6 μm,

25 specific gravity : 3.8)

The photosensitive resin composition (B) was prepared by using 60 parts of the following base polymer (f), 40 parts of the following

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ethylenically unsaturated compound (g) and 10 parts of the following photo polymerization initiator (h).

[Photosensitive resin composition (B)]

Base polymer (f)

- 5 copolymer of methyl methacrylate, n-butyl methacrylate,
2-ethylhexyl acrylate and methacrylic acid, a ratio of copolymer
50/15/10/25 based on weight
(glass transition temperature 75°C, weight average molecular
weight 60000, acid number 163 mgKOH/g)

- 10 Ethylenically unsaturated compound (g)
tetraethylene glycol dimethacrylate 25 parts
trimethylolpropane triacrylate 15 parts

Photo polymerization initiator (h)

benzyl dimethyl ketal

- 15 The obtained resin composition (A) was applied to a polyester
film having 20 μm thickness by using an applicator having 10 mil gap.
After standing at a room temperature for one and half minute, the film
was dried respectively for 3 minutes at 60, 90, 110°C to form the resin
composition (A) layer having 50 μm Ta (a protecting film was not
20 covered).

In case of the resin composition (A) layer, the layers
containing red, green, or blue fluorescent substance were respectively
prepared.

- 25 The photosensitive resin composition (B) layer having 70 μm
Tb was prepared by using the photosensitive resin composition (B) in the
same manner as mentioned above (a protecting film was not covered).

By using the obtained laminate of (A) layer and (B) layer, the

pattern of the fluorescent substance was formed according to the following process.

(Formation of the resin composition (A) layer and the photosensitive resin composition (B) layer)

- 5 To the PDP substrate (200 mm×200 mm×2 mm) preheated at 60°C in an oven having the formed cell (stripe pattern of T_0 120 μ m, width 45 μ m and slit 180 μ m), the resin composition (A) layer (laminated film) was laminated at the following condition; temperature of laminate roll 120°C, pressure of roll 3 kg/cm², rate of lamination 0.5 m/min.
- 10 After removing the polyester film, the photosensitive resin composition (B) layer (laminated film) was laminated thereon in the same manner as mentioned above to form the resin composition (A) layer and the photosensitive resin composition (B) layer.

(Exposure, Development)

- 15 In order to expose the inside of the cell (except for the upper part of the cell), pattern was put on the polyester film on the surface of the photosensitive resin composition (B) layer, and the film was exposed by using a 3 kw ultra-high-pressure mercury lamp of exposing machine HMW-523D made by Ork Manufacturing Co.,Ltd. The exposure value
- 20 was the value of step 7 measured by a stopher 21 step sensitivity guide.

After holding time of 15 minutes after exposure, the film was developed with 1 % by weight sodium carbonate aqueous solution at 30°C for twice time of the minimum developing time to form a red line. And repeating the same operations, a green line and a blue line were

25 formed.

(Baking)

Putting into the baking bath after development, the resin

component of the resin composition (A) layer and the photosensitive resin composition (B) layer were baked at 550°C to form the patterns of the red, green, blue fluorescent substances.

The obtained cell substrate having the formed pattern of fluorescent substance had no defect of pattern made by baking, and it was found by observing a cross section of the cell with SEM (Scanning Electron Microscope) that the fluorescent substance was formed effectively and uniformly from the upper to the bottom part of the wall.

10

EXAMPLE 2

The pattern of the fluorescent substance was formed by the same manner as in Example 1 except for changing the composition of the acrylic polymer in the resin composition (A) to the following composition.

The obtained cell substrate having the formed pattern of fluorescent substance had no defect of pattern made by baking, and the fluorescent substance was formed effectively and uniformly from the upper to the bottom part of the wall same as in Example 1.

Acrylic polymer (a)

copolymer of n-butyl acrylate, n-butyl methacrylate and methacrylic acid, a ratio of copolymer 45/30/25 based on weight
(glass transition temperature 12.6°C, weight average molecular weight 120000, acid number 162.7 mgKOH/g)

COMPARATIVE EXAMPLE 1

The pattern of the fluorescent substance was formed in the same manner as in Example 1 except for changing the composition of the acrylic polymer in the resin composition (A) to the following composition.

Acrylic polymer (a)

copolymer of methyl methacrylate, n-butyl acrylate and methacrylic acid, a ratio of copolymer 50/20/30 based on weight

(glass transition temperature 79.6°C, weight average molecular weight 90000, acid number 195.3 mgKOH/g)

The obtained cell substrate having the formed pattern of fluorescent substance did not give an excellent result since it formed defects due to poor following property.

EXAMPLE 3

The resin composition (A) was prepared by using 50 parts of the following acrylic polymer (a), 65 parts of the following fluorescent substance (b) (red, green, blue were separately employed) and 75 parts of the following polyhydric alcohol (c).

[Resin composition (A)]

Acrylic polymer (a)

copolymer of methyl methacrylate, n-butyl methacrylate and methacrylic acid, a ratio of copolymer 30/49/21 based on weight

(glass transition temperature 69°C, weight average molecular weight 60000, acid number 137 mgKOH/g)

Fluorescent substance (b)

(Y, Gd, Eu)BO₃ (red)

(emission wavelength : 593 nm, 610 nm, 626 nm,
particle diameter : 2 – 4 μm, specific gravity : 5.1)

(Zn, Mn)₂SiO₄ (green)

(emission wavelength : 529 nm, particle diameter : 2 – 6 μm,
specific gravity : 4.2)

(Ba, Eu)MgAl₁₀O₁₇ (blue)

(emission wavelength : 451 nm, particle diameter : 2 - 6 μ m,

specific gravity : 3.8)

Organic compound (c), polyhydric alcohol

5 polyethylene glycol

(viscosity at 20°C : 170 mPa · sec, weight average molecular weight 600)

The photosensitive resin composition (B) was prepared by using 60 parts of the following base polymer (f), 40 parts of the following ethylenically unsaturated compound (g) and 10 parts of the following photo polymerization initiator (h).

[Photosensitive resin composition (B)]

Base polymer (f)

copolymer of methyl methacrylate, n-butyl methacrylate,

15 2-ethylhexyl acrylate and methacrylic acid, a ratio of copolymer 50/15/10/25 based on weight

(glass transition temperature 75°C, weight average molecular weight 60000, acid number 163 mgKOH/g)

Unsaturated compound (g)

20 tetraethylene glycol dimethacrylate 25 parts
trimethylolpropane triacrylate 15 parts

Photo polymerization initiator (h)

benzyl dimethyl ketal

The resin composition (A) layer having 50 μ m thickness (T_a)
25 was prepared in the same manner as in Example 1 (a protecting film was not covered). In case of the resin composition (A) layer, the layers containing red, green, or blue fluorescent substance were respectively

prepared. The photosensitive resin composition (B) layer having 70 μm thickness (T_b) was prepared by using the photosensitive resin composition (B) in the same manner as mentioned above (a protecting film was not covered).

- 5 By using the obtained laminate of (A) layer and (B) layer, the pattern of the fluorescent substance was formed, exposed, developed and baked in the same manner as in Example 1.

- 10 The obtained cell substrate having the formed pattern of fluorescent substances had no defect of pattern made by baking, and it was found by observing a cross section of the cell with SEM (Scanning Electron Microscope) that the fluorescent substance was formed effectively and uniformly from the upper to the bottom part of the wall.

EXAMPLE 4

- 15 The pattern of the fluorescent substance was formed in the same manner as in Example 3 except for changing the composition of the acrylic polymer in the resin composition (A) to the following composition.

Acrylic polymer (a)

- 20 copolymer of methyl methacrylate, n-butyl methacrylate and methacrylic acid, a ratio of copolymer 50/20/30 based on weight (glass transition temperature 79.6°C, weight average molecular weight 120000, acid number 195.3 mgKOH/g)

- 25 The obtained cell substrate having the formed pattern of fluorescent substance had no defect of pattern made by baking, and the fluorescent substance was formed effectively and uniformly from the upper to the bottom part of the wall same as in Example 1.

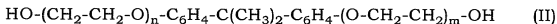
EXAMPLE 5

The pattern of the fluorescent substance was formed in the same manner as in Example 3 except for changing the polyhydric alcohol (c) in the resin composition (A) to the following compound.

5 Organic compound (c), polyhydric alcohol

compound represented by the following formula (II)

(BA-10glycol, available from Nippon Nyukazai Co.,Ltd.)



10

(wherein n and m are a positive integer, and n+m is 10)

(viscosity at 20°C : 2600 mPa · sec, weight average molecular weight 668)

15

The obtained cell substrate having the formed pattern of fluorescent substance had no defect of pattern made by baking, and the fluorescent substance was formed effectively and uniformly from the upper part to the bottom of the wall same as in Example 1.

COMPARATIVE EXAMPLE 2

20

The pattern of the fluorescent substance was formed in the same manner as in Example 3 except for mixing no polyhydric alcohol (c) in the resin composition (A).

25

The obtained cell substrate having the formed pattern of fluorescent substance did not give an excellent result since it did not have sufficient fluidity due to poor plasticity.

EXAMPLE 6

The resin composition (A) was prepared by using 50 parts of the following acrylic polymer (a), 65 parts of the following fluorescent substance (b) (red, green, blue were separately employed), 75 parts of the ethylenically unsaturated compound (c) and 2 parts of the photo polymerization inhibitor.

[Resin composition (A)]

Acrylic polymer (a)

copolymer of methyl methacrylate, n-butyl methacrylate and methacrylic acid, a ratio of copolymer 30/49/21 based on weight (glass transition temperature 69°C, weight average molecular weight 60000, acid number 137 mgKOH/g)

Fluorescent substance (b)

(Y, Gd, Eu)BO₃ (red)
(emission wavelength : 593 nm, 610 nm, 626 nm,
particle diameter : 2 - 4 μm, specific gravity : 5.1)
(Zn, Mn)₂SiO₄ (green)
(emission wavelength : 529 nm, particle diameter : 2 - 6 μm,
specific gravity : 4.2)
(Ba, Eu)MgAl₁₀O₁₇ (blue)
(emission wavelength : 451 nm, particle diameter : 2 - 6 μm,
specific gravity : 3.8)

Organic compound (c), ethylenically unsaturated compound

polyethylene glycol diacrylate
(viscosity at 20°C : 60 mPa · sec, weight average molecular weight 522)

Photo polymerization inhibitor (d)

2,2'-methylenebis(4-methyl-6-tert-butylphenol)

The photosensitive resin composition (B) was prepared by using 60 parts of the following base polymer (f), 40 parts of the following ethylenically unsaturated compound (g) and 10 parts of the following photo polymerization initiator (h).

[Photosensitive resin composition (B)]

Base polymer (f)

copolymer of methyl methacrylate, n-butyl methacrylate,
2-ethylhexyl acrylate and methacrylic acid, a ratio of copolymer
50/15/10/25 based on weight
(glass transition temperature 75°C, weight average molecular
weight 60000, acid number 163 mgKOH/g)

Unsaturated compound (g)

tetraethylene glycol dimethacrylate 25 parts
trimethylolpropane triacrylate 15 parts

Photo polymerization initiator (h)

benzyl dimethyl ketal

The resin composition (A) layer having 50 μm thickness (T_a) was prepared in the same manner as in Example 1 (a protecting film was not covered). In case of the resin composition (A) layer, the layers containing red, green, or blue fluorescent substance were respectively prepared. The photosensitive resin composition (B) layer having 70 μm thickness (T_b) was prepared by using the photosensitive resin composition (B) in the same manner as mentioned above (a protecting film was not covered).

By using the obtained laminate of (A) layer and (B) layer the

pattern of the fluorescent substance was formed, exposed, developed and baked in the same manner as in Example 1.

5 The obtained cell substrate having the formed pattern of fluorescent substances had no defect of pattern made by baking, and it was found by observing a cross section of the cell with SEM (Scanning Electron Microscope) that the fluorescent substance was formed effectively and uniformly from the upper to the bottom part of the wall.

EXAMPLE 7

10 The pattern of the fluorescent substance was formed in the same manner as in Example 6 except for changing the composition of the acrylic polymer in the resin composition (A) to the following composition.

Acrylic polymer (a)

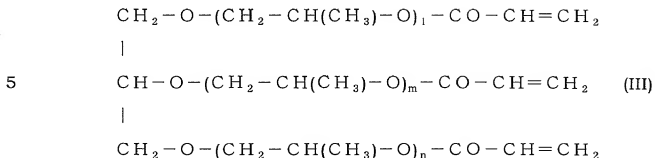
15 copolymer of methyl methacrylate, n-butyl methacrylate and methacrylic acid, a ratio of copolymer 50/20/30 based on weight (glass transition temperature 79.6°C, weight average molecular weight 120000, acid number 195.3 mgKOH/g)

20 The obtained cell substrate having the formed pattern of fluorescent substance had no defect of pattern made by baking, and the fluorescent substance was formed effectively and uniformly from the upper to the bottom part of the wall same as in Example 1.

EXAMPLE 8

25 The pattern of the fluorescent substance was formed in the same manner as in Example 6 except for changing the ethylenically unsaturated compound (c) to the following compound represented by the following formula (III).

Ethylenically unsaturated compound (c)



(wherein 1, m and n are a positive integer, and n+m is about 3.9)

(OTA-480, available from Dicel UCB Kabusikigaisya)

(viscosity at 20°C : 150 mPa · sec, weight average molecular weight 480)

The obtained cell substrate having the formed pattern of fluorescent substance had no defect of pattern made by baking, and the fluorescent substance was formed effectively and uniformly from the upper to the bottom part of the wall same as in Example 1.

COMPARATIVE EXAMPLE 3

The pattern of the fluorescent substance was formed in the same manner as in Example 6 except for mixing no ethylenically unsaturated compound (c) in the resin composition (A).

The obtained cell substrate having the formed pattern of fluorescent substance had some defects since it did not have sufficient following property.

The process for forming a pattern of fluorescent substance of the present invention is excellent in filling up property into the cell, and is useful for the application of fluorescent substance formation due to

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the no defect of pattern at baking and the effective and uniform formation of fluorescent substance pattern on the side and bottom wall of the cell, since there are filled the resin composition (A) layer containing a fluorescent substance, which is not photosensitive, and the
5 photosensitive resin composition (B) layer containing no fluorescent substance in the cell.

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WHAT IS CLAIMED IS:

1 1. A process for forming a pattern of fluorescent substance
2 into the cell of a fluorescent substance display substrate, wherein a
3 resin composition (A) layer, comprising an acrylic polymer (a) having a
4 weight average molecular weight of 10000 to 300000 and an acid
5 number of 80 to 250 mgKOH/g and a fluorescent substance (b), and a
6 photosensitive resin composition (B) layer are formed inside the cell, and
7 then they are exposed, developed and baked.

1 2. The process for forming a pattern of fluorescent
2 substance of Claim 1, wherein a glass transition temperature Tg of the
3 acrylic polymer (a) is below 30°C.

1 3. The process for forming a pattern of fluorescent
2 substance of Claim 1, wherein the glass transition temperature Tg of the
3 acrylic polymer (a) is not less than 30°C and the resin composition (A)
4 contains an organic compound (c) having viscosity of 5-15000 mPa · sec
5 at 20°C.

1 4. The process for forming a pattern of fluorescent
2 substance of Claim 3, wherein the resin composition (A) contains an
3 organic compound (c) having viscosity of 5-15000 mPa · sec at 20°C and
4 a polymerization inhibitor (d).

1 5. The process for forming a pattern of fluorescent
2 substance of Claim 3, wherein the organic compound (c) is a polyhydric

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3 alcohol compound.

1 6. The process for forming a pattern of fluorescent
2 substance of Claim 3, wherein the organic compound (c) is a compound
3 containing at least one ethylenically unsaturated group, and the resin
4 composition (A) contains a polymerization inhibitor (d).

1 7. The process for forming a pattern of fluorescent
2 substance of Claim 1, wherein the resin composition (A) contains a photo
3 polymerization initiator and/or a photo polymerization initiator
4 assistant (e).

1 8. The process for forming a pattern of fluorescent
2 substance of Claim 1, wherein the photosensitive resin composition (B)
3 layer is formed in the cell after the resin composition (A) layer is formed.

1 9. A plasma display panel, wherein a pattern of fluorescent
2 substance is formed in the cell by the process for forming a pattern of
3 fluorescent substance of Claim 1.

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Abstract of the Disclosure

A resin composition (A) layer, comprising an acrylic polymer (a) having a weight average molecular weight of 10000 to 300000 and an acid number of 80 to 250 mgKOH/g and a fluorescent substance (b), and a photosensitive resin composition (B) layer are formed inside the cell, and then they are exposed, developed and baked. By the process of the present invention the fluorescent substance can be effectively and uniformly formed on the side and bottom wall of the cell.

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FIG. 1(a)

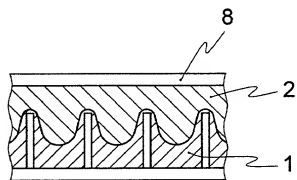


FIG. 1(b)

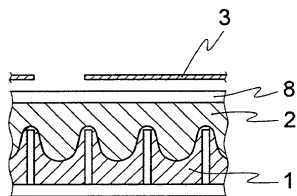


FIG. 1(c)

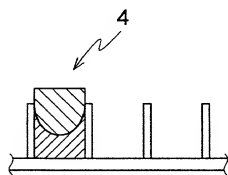
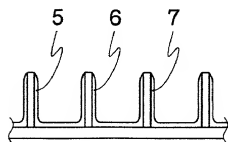


FIG. 1(d)



Declaration and Power of Attorney For Patent Application

特許出願宣言書

Japanese Language Declaration

私は、下欄に氏名を記載した発明者として、以下のとおり宣言する：

私の住所、郵便の宛先および国籍は、下欄に氏名に続いて記載したとおりであり、

名称の発明に関し、請求の範囲に記載した特許を求める主題の本来の、最初にして唯一の発明者である（一人の氏名のみが下欄に記載されている場合）か、もしくは本来の、最初にして共同の発明者である（複数の氏名が下欄に記載されている場合）と信じ、

その明細書を
(該当する方に印を付す)

☐ ここに添付する。

☐ _____ 日に出願番号

第 _____ 号として提出し、

_____ 日に補正した。
(該当する場合)

私は、前記のとおり補正した請求の範囲を含む前記明細書の内容を検討し、理解したことを陳述する。

私は、連邦規則法典第37部第1章第56条(a)項に従い、本願の審査に所要の情報を開示すべき義務を有することを認める。

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

PROCESS FOR FORMING A PATTERN OF

FLUORESCENT SUBSTRATE AND PLASMA

DISPLAY PANEL

the specification of which

(check one)

☒ is attached hereto;

☐ was filed on _____ as

Application Serial No. _____

and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Japanese Language Declaration

私は、合衆国法典第35部第119条にもとづく下記の外国特許出願または発明者証出願の外国優先権利益を主張し、さらに優先権の主張に係る基礎出願の出願日前の出願日をする外国特許出願または発明者証出願を以下に明記する:

Prior foreign applications

先の外国出願

91005/1998	Japan	18/3/1998
(Number)	(Country)	(Day Month Year Filed)
(番 号)	(国 名)	「出願の年月日」
91006/1998	Japan	18/3/1998
(Number)	(Country)	(Day Month Year Filed)
(番 号)	(国 名)	「出願の年月日」
91007/1998	Japan	18/3/1998
(Number)	(Country)	(Day Month Year Filed)
(番 号)	(国 名)	「出願の年月日」

Priority claimed

優先権の主張

<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
あり	なし
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
あり	なし
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
あり	なし

私は、合衆国法典第35部第120条にもとづく下記の合衆国特許出願の利益を主張し、本願の請求の範囲各項に記載の主題が合衆国法典第35部第112条第1項に規定の態様で先の合衆国出願に開示されていない限度において、先の出願の出願日と本願の国内出願日またはPCT国際出願日の間に公表された連邦規則法典第37部第1章第56条(a)項に記載の所要の情報を開示すべき義務を有することを認める:

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)
(出願番号)

(Filing Date)
(出願日)

(現 況)
(特許済み、係属中、放棄済み)

(Status)
(patented, pending, abandoned)

(Application Serial No.)
(出願番号)

(Filing Date)
(出願日)

(現 況)
(特許済み、係属中、放棄済み)

(Status)
(patented, pending, abandoned)

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Japanese Language Declaration

委任状: 私は、下記発明者として、以下の代理人をここに委任し、本願の手続を遂行すること並びにこれに關する一切の行為を特許庁等に対して行うことを委任する
代理人氏名および登録番号を明記のこと

John M. Belz, Reg. 30359
Herbert C. Rose, Reg. 29846
Jeffrey A. Wyand, Reg. 29458
Frederick N. Samuels, Reg. 34715

POWER OF ATTORNEY. As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

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唯一のまたは第一の発明者の氏名	Full name of sole or first inventor Hiroaki Satoh	
同発明者の署名	日付	Inventor's signature Date Hiroaki Satoh 25/2/1999
住所	Residence Ibaraki-shi, Osaka-fu, Japan	
国籍	Citizenship Japanese	
郵便の宛先	Post Office Address c/o The Nippon Synthetic Chemical Industry Co., Ltd., Central Research Laboratory, 13-1, Muroyama 2-chome, Ibaraki-shi, Osaka-fu, Japan	
第2の共同発明者の氏名 (該当する場合)	Full name of second joint inventor, if any	
同第2発明者の署名	日付	Second Inventor's signature Date
住所	Residence	
国籍	Citizenship	
郵便の宛先	Post Office Address	

(第六またはそれ以降の共同発明者に対しても同様な情報および署名を提供すること。)

(Supply similar information and signature for third and subsequent joint inventors.)

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

HIROAKI SATOH

Serial No:

Filed: March 18, 1999

For: PROCESS FOR FORMING A
PATTERN OF FLUORESCENT
SUBSTRATE AND PLASMA
DISPLAY PANEL

ASSOCIATE POWER OF ATTORNEY

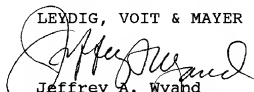
Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

I, JEFFREY A. WYAND, attorney of record in the referenced
patent application, grant an Associate Power of Attorney to
XAVIER PILLAI, Registration Number 39,799.

Respectfully submitted,

LEYDIG, VOIT & MAYER



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Registration No. 29,458

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